



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213

AUG 20 2002

In Reply Refer To:.
SWR-01-SA-5638:HLB

Mr. Michael G. Ritchie
Division Administrator
Federal Highway Administration
980 Ninth Street, Suite 400
Sacramento California 95814-2724

Dear Mr. Ritchie:

Enclosed is a biological opinion prepared by the National Marine Fisheries Service (NOAA Fisheries) pursuant to Section 7 of the Endangered Species Act (ESA) that addresses the potential effects of the State Route 299 Bridge Replacement Project on federally listed endangered Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*), threatened Central Valley spring-run Chinook salmon (*O. tshawytscha*), threatened Central Valley steelhead (*O. mykiss*), and their respective designated critical habitat (Enclosure 1).

Based on the best available scientific and commercial information, the biological opinion concludes that this project is not likely to jeopardize these species or adversely modify critical habitat. NOAA Fisheries has also included reasonable and prudent measures with non-discretionary terms and conditions that are necessary and appropriate to minimize the potential for incidental take associated with the project.

The enclosed biological opinion contains an analysis of the effects of the proposed action on designated critical habitat. Shortly before the issuance of this opinion, however, a federal court vacated the rule designating critical habitat for the Central Valley spring-run Chinook salmon ESU, and the Central Valley steelhead ESU. The analysis and conclusions regarding critical habitat remain informative for our application of the jeopardy standard even though they no longer have independent legal significance. Also, in the event critical habitat should be redesignated before the proposed action is fully implemented, the analysis will be relevant when determining whether a reinitiation of consultation would be necessary at that time. For these reasons, our critical habitat analysis remains.

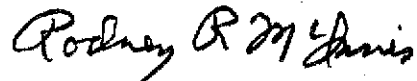
Also enclosed is the Essential Fish Habitat (EFH) consultation for Pacific salmon as required by the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) as amended (16 U.S.C. 1801 et seq.). This document (Enclosure 2), which adopts the non-discretionary Reasonable and Prudent Measures as well as the



discretionary conservation recommendations of the biological opinion (Enclosure 1), concludes that the State Route 299 Bridge Replacement Project will have an adverse effect on the EFH of Pacific Salmon in the action area.

If you have any questions regarding this correspondence please contact Mr. Howard Brown in our Sacramento Area Office, 650 Capitol Mall, Suite 8-300, Sacramento, CA 95814. Mr. Brown may be reached by telephone at (916) 930-3608 or by Fax at (916) 930-3629.

Sincerely,

A handwritten signature in black ink, reading "Rodney R. McInnis". The signature is written in a cursive, slightly slanted style.

Rodney R. McInnis
Acting Regional Administrator

cc: NMFS-PRD, Long Beach, CA
Stephen A. Meyer, ASAC, NMFS, Sacramento, CA
Tom Balkow, California Department of Transportation, 1657
Riverside Drive, Redding, CA 96001
Jack Miller, California Department of Fish and Game, 601 Locust
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Harry Rectenwald, California Department of Fish and Game, 601
Locust St, Redding CA, 96001

Enclosure 1

Endangered Species Act -Section 7 Consultation

BIOLOGICAL OPINION

Agency: Federal Highway Administration
Activity: State Route 299 Bridge Replacement Project
Consultation Conducted By: Southwest Region, National Marine Fisheries Service
Date Issued: AUG 20 2002

I. CONSULTATION HISTORY

This document represents the National Marine Fisheries Service's (NMFS) biological opinion (Opinion) based on our review of information provided by the Federal Highway Administration (FHWA) and the California Department of Transportation (Caltrans) on the State Route 299 Bridge Replacement Project. This Opinion is prepared in accordance with section 7 of the Endangered Species Act of 1973, as amended (6 U.S.C. 1531 et sq.) (Act).

Beginning on November 29, 1999, Caltrans notified NMFS of a proposed project to widen the State Route 299 bridge over the Sacramento River in Redding, California and provided an initial project description to widen the bridge and conduct structural and scour repair to existing bridge piers.

On January 11, 2000, Caltrans held an initial meeting with California Department of Fish and Game (DFG), and NMFS, to discuss the project.

NMFS received an October 2, 2000 letter from Caltrans informing that the project proposal would consider bridge replacement depending on NMFS in-water work requirements. This letter also summarized salmonid spawning habitat survey results within the vicinity of the bridge, discussed concerns about using anti-spawning fencing, and requested concurrence from NMFS and DFG that steelhead spawning does not occur within 200 yards of the existing bridge.

On October 25, 2000, NMFS received a letter from Caltrans clarifying their desire to utilize a winter work window. Caltrans justified this position by evaluating the project site for spring-run Chinook and steelhead spawning suitability. In this letter, Caltrans contended that the site is not conducive to spring-run Chinook and steelhead spawning due to unsuitable stream velocities. Caltrans further stated

that three years of aerial redd surveys, conducted by DFG between August and September, have not identified spring-run Chinook redds within one quarter of a mile of the bridge.

On May 4, 2001, NMFS received a letter from the FHWA requesting formal consultation, pursuant to Section 7 of the ESA, for the State Route 299 Bridge Replacement/Widening Project over the Sacramento River in Redding, California. A Biological Assessment (BA) that assessed the effects of the project on federally listed endangered Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*), threatened Central Valley spring-run Chinook salmon (*O. tshawytscha*), threatened Central Valley steelhead (*O. mykiss*), candidate Central Valley fall/late fall-run Chinook salmon (*O. tshawytscha*), and their respective designated critical habitat or essential fish habitat (EFH) was included in the initiation package.

On August 15, 2001, a meeting was held with representatives of NMFS, the California Department of Fish and Game (DFG) and Caltrans. The primary objective of the meeting was to identify acceptable work windows and other measures necessary to avoid, minimize, and compensate for project effects to listed species.

On August 17, 2001, NMFS requested, from the FHWA, a 60 day extension of the consultation period due to continued collection of information needs and ongoing discussion with Caltrans.

An August 20, 2001, letter from Caltrans was received by NMFS which included additional material to supplement the original BA and identified bridge replacement as the selected alternative. The additional information confirmed work windows and mitigation measures identified at the August 15, 2001 meeting, and agreed to by DFG, NMFS, and Caltrans.

During a November 5, 2001, telephone conversation between Caltrans Environmental Specialist Tom Balkow and NMFS Fishery Biologist Howard Brown, NMFS was notified that Caltrans was still considering a bridge widening alternative.

In a December 6, 2001 letter, NMFS requested additional information from Caltrans, specifying that a single preferred project alternative be selected so that impacts on Sacramento River winter-run Chinook and Central Valley spring-run Chinook and Central Valley steelhead could be fully evaluated.

On December 13, 2001, NMFS fisheries biologist, Howard Brown met with Caltrans environmental specialist, Tom Balkow to discuss the project. At this meeting, Mr. Balkow informed Mr. Brown that Caltrans would proceed with the Bridge Replacement alternative but that additional project changes were being considered including constructing a retaining wall along the southwest side of State Route 299, and constructing a segment of a storm drain outfall for the City of

Redding. Compensation measures to offset anticipated effects of these project changes were discussed.

On January 28, 2002, NMFS received a faxed letter from Caltrans specifying that the Bridge Replacement Alternative is the preferred alternative, and an embankment fill would be used along the southwest side of State Route 299 in lieu of a retaining wall. The fax cover sheet from Tom Balkow also indicated that the storm drain outfall had been dropped from consideration and would not take place under this project.

On May 23, 2002, NMFS received a May 9, 2002 additional information letter from Caltrans identifying a need to conduct soil testing throughout the project area to determine soil types. In order to accomplish this testing, Caltrans identified the need to use drilling equipment at several locations within the Sacramento River Channel.

This biological opinion is based on information provided in the April 26, 2001 letter from FHWA, the BA, a letter from Daniel Whitley, supplementing the original BA and documenting agreed upon avoidance, minimization, and compensation measures, the January 28, 2002 letter from Caltrans specifying the preferred alternative, the May 9, 2002 letter adding test drilling to the project description, the May 23, 2002 letter from Tom Balkow addressing the need to test drill, and other written correspondence and telephone conversations between Mike Tucker (NMFS), Harry Rectenwald (DFG), Daniel Whitley (Caltrans), Tom Balkow, Mike Aceituno (NMFS), Howard Brown, and Michelle Simpson (NMFS). A complete administrative record of this consultation is on file at the NMFS Sacramento Field Office.

II. DESCRIPTION OF THE PROPOSED ACTION

FHWA in cooperation with Caltrans, proposes to replace the State Route 299 Bridge across the Sacramento River immediately east of downtown Redding, in Shasta County, California. The purpose of the replacement is to treat existing scour problems and increase bridge capacity. Bridge replacement is expected to last three construction seasons. The existing bridge is a 227 meter long concrete "I" girder structure with two abutments and six piers in the water. The easternmost pier is out of the water from approximately September through December. The existing bridge consists of two separate superstructures with each structure carrying two lanes of traffic. Construction is anticipated to begin in the spring of 2004 and proceed over four years. Construction access will occur, primarily, from the northeast and southeast corners with limited access from the northwest corner. Equipment and material will be staged near the southeast quadrant of the bridge at a gravel extraction site used for the construction of Shasta Dam. Existing gravel roads that access the SE and NE corners of the bridge will be used during construction.

The replacement bridge will be built in the same location as the

existing bridge. The replacement bridge will contain seven lanes, three eastbound and four westbound, with inside and outside shoulders, a concrete median barrier, and outside railing. The new structure will be built with three sets of piers, each comprised of six piles. The existing piers will be removed. Embankment fill will be required to widen the approach ramp on the southwest side of the bridge. Construction access and approach ramp widening will require the removal of approximately 2.6 acres of riparian vegetation. Following construction, the new in-channel footprint of the bridge will be smaller than the existing footprint.

The construction sequence will involve removing one of the existing superstructures and shifting traffic to the remaining structure. Demolition will occur from the bridge surface and falling material will be captured below, on a platform supported by girders. A trestle work bridge will be constructed on one side of the bridge, with stubs underneath the bridge, along both sides of the five existing piers and along one side of the three new piers. The trestle parallel to the bridge will be 650 feet long and each of the sub trestles will be about 150 feet. Total stubs will be approximately 1,950 feet and total trestles will be approximately 2,600 feet. Solid "H" or round steel piles will be driven to support the work trestles and will be left in place until bridge construction is complete. Five foot diameter cast-in-steel-shell (CISS) hollow piles will be driven into the riverbed for each pile. CISS shells will be driven into the riverbed without the use of coffer dams. Fill material will be augured out from within the pile and replaced with concrete. Existing piers and pile caps will be removed and portions of the old piles will be cut to approximately one foot below the riverbed. Additional temporary piles, or columns, will be placed in the water to support the bridge forms and the superstructure will be cast. Cofferdams will primarily be used to isolate piers that will be removed. Cofferdams will encompass some CISS piles when they are adjacent to replacement piers. Cofferdams will be dewatered by sump pumps and waste water will be pumped to a detention basin in the southeast quadrant. This work will be followed by the removal of the forms, falsework, and temporary columns and piles. This same sequence will be used to complete the second half of the bridge.

Subsurface soil testing will be conducted to identify soil types throughout the project area. Two drilling locations will be used within the Sacramento River channel. Drilling equipment will be lowered from the existing bridge onto existing islands on the north and south side. If necessary, riparian vegetation will be cleared to make room for the equipment in the same area that will be impacted by bridge construction activities. Clean, washed gravel or wooden platforms may be used to expand the size of the work area for the drilling rig. Drilling will be conducted through the gravel of the island. All materials such as drilling mud, sediment, and gravel borings will be contained and/or recirculated within the drill casing, and removed to either a maintenance yard, or incorporated into the

project fill outside of the Sacramento River channel. Three drill locations will also be required within the lagoon on the south side of the western approach ramp. These locations will require drilling in the water at the base of the existing embankment fill. This work will be conducted off a barge launched from a ramp within the lagoon. Several additional drilling locations will be required throughout the project area. These additional locations will be on dry land and will not require removal of riparian vegetation.

To avoid, minimize, and compensate for potential impacts to Central Valley steelhead, Sacramento River winter-run Chinook and Central Valley spring-run Chinook salmon, Caltrans has integrated the following design features into the project description:

1. To minimize effects from increased turbidity and sedimentation, Caltrans will meet Regional Water Quality Control Board (RWQCB) water quality objectives for the Sacramento River Basin. As part of this process, a monitoring and reporting program will be followed under the Waste Discharge Requirements. This program will require effluent, receiving water, and storm water sampling, analysis and reporting to the RWQCB. Project discharge cannot exceed the RWQCB water quality objectives for the Sacramento River Basin. These objectives include increases no greater than:
 - 1 Nephelometric Turbidity Unit (NTU) when natural turbidity is between 0 and 5 NTUs.
 - 20 percent of natural turbidity levels when natural turbidity is between 5 and 50 NTUs.
 - 10 NTUs when natural turbidity is between 50 and 100 NTUs.
 - 10 percent when natural turbidity is greater than 100 NTUs.

A Storm Water Prevention Plan (SWPP) will be developed by the construction contractor once the project is awarded. This plan will be approved through Caltrans to ensure that water quality control measures will be implemented before, during, and after the construction of the bridge. Caltrans standard water quality specifications will be incorporated into the construction contract. These specifications outline the activities the contractor is required to perform, including erosion and sediment control. The specifications also direct the development of a SWPP that addresses soil stabilization, sediment control, waste management, and material pollution control. Some standard specifications require consideration and implementation of Best Management Practices (BMPs) that utilize temporary measures such as silt fences, straw bales, erosion control seeding, straw mulch, construction windows, and halting work if a sediment plume is observed in the water. Other specifications require spill prevention, response, and clean-up measures

2. To compensate for temporary and permanent losses of riparian vegetation, Caltrans will replace lost vegetation at a six acre site along lower Sulphur Creek. Sulphur Creek flows into the Sacramento River approximately one mile upstream of the bridge site and supports limited salmonid use. Caltrans will also revegetate riparian zones impacted by access points and land recovered by pier removal. If, for some reason, the Sulphur Creek site is not suitable, an equal amount of vegetation will be compensated for at DFG's Battle Creek mitigation site.

3. To avoid impacts to Sacramento River winter-run Chinook salmon eggs, and redds in the vicinity of the project area, Caltrans will restrict all percussive and in-channel work to the period between September 15 and April 15. If the contractor requires an earlier start, a qualified biologist will conduct a survey for Sacramento River winter-run Chinook salmon redds beginning September 1. These surveys will consist of a combination of boat and helicopter visual observations. If no redds are found within 200 feet of the percussive work area, then the contractor will be allowed to begin percussive work prior to September 15 but no earlier than September 1.

4. Caltrans will construct a gravel work pad in the river at the eastern side of the bridge out of clean, washed gravel. The work pad will protrude above the water surface and extend into the river approximately 220 feet from the east bank. The pad will cover suitable spawning habitat along the eastern side of the bridge and form a temporary above-water work area during average winter flow conditions. Covering this suitable habitat will prevent salmon and steelhead from spawning in this portion of the project area for the duration of the project construction. The pad will be allowed to wash out following bridge construction and augment existing spawning gravel supplies.

5. Upstream and downstream anadromous fish passage will be maintained at all times. Limited coffer dam construction and construction of a gravel pad to access the first two piers will leave 200 feet of river-width available for fish passage. Percussive work will not occur at night, resulting in quite conditions during peak fish migration periods.

Description of the Action Area

The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR § 402.02). The action area, for the purpose of this Opinion, encompasses an area that begins 300 feet upstream of the bridge and extends 500 feet downstream of the bridge. This area was selected because it represents the upstream extent of anticipated acoustic effects from pile driving, and the downstream extent of anticipated effects related to sediment and turbidity.

III. STATUS OF THE SPECIES AND CRITICAL HABITAT

This Opinion analyzes the effects of the State Route 299 Bridge Replacement Project on the following threatened and endangered species and their critical habitats:

1. Sacramento River winter-run Chinook salmon - endangered
2. Central Valley spring-run Chinook salmon - threatened
3. Central Valley steelhead - threatened

Sacramento River Winter-Run Chinook Salmon

Sacramento River Chinook salmon (winter-run Chinook) were originally listed as threatened in November, 1990 (55 FR 46515). Their status was reclassified as endangered in January, 1994 (59 FR 440) due to continued decline and increased variability of run sizes since their listing as a threatened species, expected weak returns as a result of two small year classes in 1991 and 1993, and continued threats to the population. In the proposed rule to reclassify the winter-run Chinook as endangered, NMFS recognized that the population had dropped nearly 99% between 1966 and 1991, and despite conservation measures to improve habitat conditions, the population continued to decline (57 FR 27416). A draft recovery plan was published in August 1997 (NMFS 1997).

Critical habitat for winter-run Chinook was designated on June 16, 1993 and includes the Sacramento River from Keswick Dam (RM 302) downstream to Chipps Island (RM 0) at the westward margin of the Sacramento-San Joaquin Delta; all waters from Chipps Island westward to Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait; all waters of San Pablo Bay westward of the Carquinez Bridge; and all waters of the San Francisco Bay (north of the San Francisco Bay Bridge) from San Pablo Bay to the Golden Gate Bridge. The critical habitat designation identifies those physical and biological features of the habitat that are essential to the conservation of the species and that may require special management consideration or protection. Within the Sacramento River this includes the river water, river bottom (including those areas and associated gravel used by winter-run Chinook as spawning substrate), and adjacent riparian zone used by fry and juveniles for rearing.

Winter-run Chinook historically spawned in the headwaters of the McCloud, Pit, and Little Sacramento rivers and Hat and Battle creeks. Construction of Shasta Dam in 1943 and Keswick Dam in 1950 blocked access to all of these waters except Battle Creek, which is blocked by a weir at the Coleman National Fish Hatchery and other small hydroelectric facilities (Moyle 1989, NMFS 1997). Until 1984, the upper Calaveras River also contained a run of several dozen to several hundred fish that spawned below New Hogan Dam. Low river flows in the Calaveras during the 1987-1992 drought are believed to have eliminated

this population (DFG 1998). Most of the current winter-run Chinook spawning and rearing habitat exists between Keswick Dam and Red Bluff Diversion Dam (RBDD). Although a small, unknown, number of winter-run Chinook are thought to spawn in Battle Creek, the ESU is widely considered to be reduced to a single population in the mainstem Sacramento River below Keswick Dam.

Following the construction of Shasta Dam, the number of winter-run Chinook initially declined but recovered during the 1960s. This initial recovery was followed by a steady decline from 1969 through the late 1980s (USFWS 1999).

Adult winter-run Chinook enter San Francisco Bay from November through June (Hallock and Fisher 1985) and migrate past RBDD from mid-December through early August (NMFS 1997). The majority of the run passes RBDD from January through May, and peaks in mid-March (Hallock and Fisher 1985). Generally, winter-run Chinook spawn from near Keswick dam, downstream to Red Bluff. Spawning occurs from late-April through mid-August with peak activity between May and June. Eggs and pre-emergent fry require water temperatures at or below 56 F for maximum survival during the spawning and incubation period (USFWS 1999). Fry emerge from mid-June through mid-October and move to river margins to rear. Emigration past RBDD may begin in mid-July and typically peaks in September and can continue through March in dry years (NMFS 1997, Vogel and Marine 1991). From 1995 to 1999, all winter-run Chinook outmigrating as fry passed RBDD by October, and all outmigrating pre-smolts and smolts passed RBDD by March (Martin et al. 2001).

Construction of RBDD in 1966 enabled improved accuracy of population estimates as salmon passed through fish ladders. From 1967 to 2000, winter-run Chinook estimates were extrapolated from adult counts at RBDD ladders. Recent operational changes at RBDD have allowed a majority of the winter-run Chinook population to bypass the ladders and counting facilities, and has increased the error associated with extrapolating the population estimate. Beginning in 2001, carcass counts replaced the ladder count to reduce the error associated with the estimate.

Since 1967, the estimated adult winter-run Chinook population ranged from 186 in 1994 to 117,808 in 1969 (CDFG 2002). The estimate declined from an average of 86,000 adults in 1967-1969 to only 2,000 by 1987-1989, and continued downward to an average 830 fish in 1994-1996. Since then, estimates have increased to an average of 3,136 fish for the period of 1998-2001. Winter-run abundance estimates and cohort replacement rates since 1986 are shown in table 1. Although the population estimates display broad fluctuation since 1986 (186 in 1994 to 5,523 in 2001), there is an increasing trend in the five year moving average over the last five year period (491 from 1990-1994 to 2609 from 1997-2001), and a generally stable trend in the five year moving average of cohort replacement rates. The 2001 run was the highest since the listing, with an estimate of 5,523 adult fish.

Table 1.- Winter-run Chinook population estimates from Red Bluff Diverion Dam counts, and corresponding cohort replacement rates for years since 1986.

Year	Population Estimate	5 Year Moving Average of Population Estimate	Cohort Replacement Rate	5 Year Moving Average of Cohort Replacement Rate
1986	2596	-	0.27	-
1987	2186	-	0.20	-
1988	2886	-	0.07	-
1989	697	-	1.78	-
1990	431	1759	0.90	0.64
1991	211	1282	0.88	0.77
1992	1241	1093	1.04	0.93
1993	387	593	3.45	1.61
1994	186	491	4.73	2.20
1995	1287	662	2.33	2.49
1996	1337	888	1.71	2.65
1997	880	815	1.54	2.75
1998	3005	1339	1.84	2.43
1999	2288	1759	-	-
2000	1352	1772	-	-
2001	5521	2609	-	-

Numerous factors have contributed to the decline of winter-run Chinook by degrading spawning, rearing, and migration habitats. The primary impacts include warm water releases from Shasta Dam, juvenile and adult passage constraints at RBDD, water exports in the south delta, acid mine drainage from Iron Mountain Mine, and entrainment at a large number of unscreened and poorly screened water diversions. Secondary factors that have contributed to the decline of winter-run Chinook include smaller water manipulation facilities and dams, loss of rearing habitat in the lower Sacramento River and Sacramento-San Joaquin Delta from levee construction and marshland reclamation, and the interaction and predation by introduced species (NMFS 1997).

Since the listing of winter-run Chinook, many habitat problems that led to the decline of the species have been addressed and improved through restoration and conservation actions. The impetus for initiating restoration actions stem primarily from ESA requirements, State Water Resources Control Board (SWRCB) orders requiring compliance with Sacramento River water temperature objectives, a 1992 amendment to the authority of the Central Valley Project (CVP) through the Central Valley Project Improvement Act (CVPIA) to give fish and wildlife equal priority with other CVP objectives, fiscal support of habitat improvement projects from the CALFED Bay-Delta Program, and EPA pollution control efforts.

The 1993 Biological Opinion (1993 Opinion) that addressed the effects of the Bureau of Reclamation's (BOR) operation of the Central Valley Project (CVP) and the California Department of Water Resource's (DWR) operation of the State Water Project (SWP) on winter-run Chinook (winter-run opinion) identified reasonable and prudent alternatives (RPAs) necessary to avoid the likelihood of jeopardizing the species. Some of the RPAs include a minimum end-of-the-year carryover storage in Shasta Reservoir of 1.9 million acre feet, minimum flow requirements of 3,250 cubic feet per second (CFS) from Keswick Dam from October 1 through March 31, identification of ramp down rates to minimize stranding of juveniles, water temperature objectives of no more than 56° F from Keswick Dam to Jelly's Ferry or Bend Bridge, depending on the water year type, adjusted operational schedule of RBDD to facilitate maximum upstream passage of adults and downstream passage of juveniles, and closing of the Delta Cross Channel Gates from February 1 to April 30, and monitored operation of the Gates from October 1 through January 31 to reduce the diversion of juvenile emigrants into the delta.

The 1993 Opinion, along with SWRCB water temperature compliance orders led to the construction of a temperature control device (TCD) at Shasta Dam. The TCD became operable in 1997 and has allowed improved water temperature management by allowing the BOR cold water releases from Shasta Reservoir.

With the passage of the CVPIA in 1992, the Secretary of the Interior was directed to develop the Anadromous Fish Restoration Program (AFRP) and make all reasonable efforts to at least double natural production of anadromous fish in California's Central Valley streams. Numerous actions have been funded to increase winter-run Chinook production, including acquisition of Sacramento River riparian habitat, increased law enforcement, fish screens at major Sacramento River diversions, and spawning gravel augmentation. Section B2 of the CVPIA also established a water account to provide water for anadromous fish, and to improve water quality in the Delta. B2 water is commonly used to minimize the effects of flow fluctuations by supplementing CVPIA minimum flow requirements.

The CALFED Bay-Delta Program was established in 1995 with a mission to develop and implement a long-term comprehensive plan that will restore ecological health and improve water management for beneficial uses of the Bay-Delta System. Fundamental to this plan is a goal of recovering at-risk native species dependant on the Delta and Suisun Bay, including anadromous salmonids of the Central Valley. To aid this plan, CALFED established the Ecosystem Restoration Program (ERP) to guide restoration actions. To date, CALFED has funded numerous restoration projects that benefit winter-run Chinook, including a state of the art fish screens and fish passage designs at Anderson-Cottonwood Irrigation District (ACID) diversion and dam, Glenn-Colusa Irrigation District (GCID), Reclamation District 108, Princeton-Cordura-Glenn & Provident Irrigation District, and other smaller

diversions. In addition to the ERP, the CALFED program also established an Environmental Water Account (EWA) to increase protection of anadromous fish through better management of Central Valley Water. The account buys water from willing sellers or diverts surplus water when safe for fish, then banks, stores, transfers and releases it as needed to protect fish and compensate water users. EWA managers also coordinate with water project operators to curtail pumping at specific times to avoid harming fish.

Since 1986, the Federal Environmental Protection Agency (EPA) has implemented remedial actions at Iron Mountain Mine. The completion of a lime neutralization plant is successfully removing significant concentrations of toxic metals in acidic mine drainage from the Spring Creek Watershed. According to the EPA, the existing pollution control system removes up to 75% of the toxic compounds emitted from the mine. A large dam currently under construction on Slickrock Creek will ultimately enable a 95% toxicity reduction.

NMFS' 1997 draft recovery plan for winter-run Chinook states that when the underlying causes of the species' decline are no longer in effect and the species has reached population levels in which the probability of extinction is very low, it can be removed from the endangered species list (NMFS 1997). In general, the population criteria for delisting winter-run Chinook requires the mean annual spawning abundance over any 13 consecutive years shall be 10,000 females and the geometric mean of the cohort replacement rate (CHR) over those same 13 years shall be greater than 1.0. Estimates of these criteria shall be based on natural production alone and shall not include hatchery fish. Recent trends in winter-run Chinook abundance and cohort replacement are positive and indicate some recovery since the listing, however, the population remains well below the recovery goals of the draft recovery plan, and is particularly susceptible to extinction due to loss of genetic variation resulting from the reduction of the ESU to one population.

Central Valley Spring-Run Chinook Salmon

NMFS listed the Central Valley spring-run Chinook salmon (spring-run Chinook) ESU as threatened on September 16, 1999 (64 FR 50394). Historically, spring-run Chinook were the dominant run in the Sacramento River Basin, occupying the middle and upper elevation reaches (1,000-6000 ft) of most streams and rivers with sufficient habitat for over-summering adults (Clark 1929). Clark estimated that there were 6,000 miles of salmon habitat in the Central Valley Basin (much of which was high elevation spring-run Chinook habitat) and that by 1928, 80% of this habitat had been lost. Yoshiyama et al. (1996) determined that, historically, there were approximately 2,000 miles of salmon habitat available prior to dam construction and mining and that only 18% of that habitat remains.

NMFS designated critical habitat for spring-run Chinook on February 16, 2000 (65 FR 7764). Critical habitat for Central Valley ESU spring-run Chinook is designated to include all river reaches accessible to Chinook salmon in the Sacramento River and its tributaries in California. Also included are river reaches and estuarine areas of the Sacramento-San Joaquin Delta, all waters from Chipps Island westward to Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait; all waters of San Pablo Bay westward of the Carquinez Bridge; and all waters of the San Francisco Bay (north of the San Francisco Bay Bridge) from San Pablo Bay to the Golden Gate Bridge. Excluded are areas above specific dams or above longstanding naturally impassable barriers. Critical habitat consists of the water, substrate, and adjacent riparian zone of accessible estuarine and riverine reaches. Accessible reaches are those within the historical range of the spring-run Chinook ESU that can still be occupied by any life stage. Inaccessible reaches are those above longstanding, naturally impassable barriers (i.e., waterfalls in existence for at least several hundred years) and specific dams within the historical range of each ESU.

Adult spring-run Chinook enter the Delta from the ocean beginning in January and enter natal streams from March to July. In Mill Creek, Van Woert (1964) noted that of 18,290 spring-run Chinook observed from 1953 to 1963, 93.5 percent were counted between April 1 and July 14, and 89.3 percent were counted between April 29 and June 30.

During their upstream migration, adult spring-run require streamflows sufficient to provide olfactory and other orientation cues used to locate their natal streams. Adequate streamflows are also necessary to allow adult passage to upstream holding habitat. The preferred temperature range for spring-run Chinook upstream migration is 38° F to 56° F (Bell 1991; CDFG 1998). Spring-run may also utilize tailwaters below dams if cold water releases are suitable.

Upon entering fresh water, spring-run Chinook are sexually immature and must hold in cold water for several months to mature. Typically, spring-run Chinook utilize mid to high elevation streams that provide sufficient flow, water temperature, and cover, and pool depth to allow over-summering.

Spawning occurs between September and October and, depending on water temperature, emergence occurs between November and February. The optimum temperature range for Chinook salmon egg incubation is 44° F to 54° F (Rich 1997). Incubating eggs show reduced viability and increased mortality at temperatures greater than 58° F and show 100% mortality for temperatures greater than 63° F (Velson 1987). Velson (1987) and Beacham and Murray (1990) found that developing Chinook salmon embryos exposed to water temperatures of 35° F or less before the eyed stage experienced 100% mortality (CDFG 1998).

Timing of emergence is strongly influenced by water temperature. Early emergence (November-December) is common at warmer low elevation habitats such as in Big Chico and Butte Creeks, while later emergence (January-February) is more typical in the cooler higher elevation habitats of Deer and Mill Creeks (CDFG 1998, Harvey Arrison personal communication). Post-emergent fry move to shallow, near shore areas with slow current and good cover, and feed on small terrestrial and aquatic insects. As they grow to 50 to 75 mm in length, the juvenile salmon move out into deeper, swifter water, but continue to use available cover to minimize the risk of predation and reduce energy expenditure.

Spring-run emigration is highly variable (CDFG 1998). Some may begin outmigrating soon after emergence while others oversummer and emigrate as yearlings with the onset of increased fall storms (CDFG 1998). The emigration period for spring-run Chinook extends from November to early May.

Outmigrants may rear in non-natal tributaries to the Sacramento River, and the Delta. In general, emigrating juveniles that are younger (smaller) reside longer in the Delta (Kjelson et al. 1982, Levy and Northcote 1982, Healey 1991). Although juvenile spring-run can enter the Delta as early as January and as late as June, their length of residency within the Delta is unknown but probably lessens as the season progresses into the late spring months (CDFG 1998).

Chinook salmon spend between one and four years in the ocean before returning to their natal streams to spawn (Myers et al. 1998). Fisher (1994) reported that 87% of Chinook trapped and examined at RBDD between 1985 and 1991 were three-years-olds.

Spring-run Chinook were once the most abundant run of salmon in the Central Valley (Campbell and Moyle 1991) and were found in both the Sacramento and San Joaquin drainages. More than 500,000 spring-run Chinook were caught in the Sacramento-San Joaquin commercial fishery in 1883 alone (Yoshiyama et al. 1998). Principal holding and spawning areas were in the middle reaches of the San Joaquin, American, Yuba, Feather, upper Sacramento, McCloud, and Pit Rivers with smaller populations in tributaries with cold water conditions suitable to support the fish through the summer (CDFG 1995). The San Joaquin populations were essentially extirpated by the 1940s, with only small remnants of the run that persisted through the 1950s in the Merced River (Hallock and Van Wort, 1959, Yoshiyama 1998). Populations in the upper Sacramento, Feather, and Yuba Rivers were eliminated with the construction of major dams during the 1950s and 1960s. Naturally spawning populations of spring-run Chinook are currently restricted to accessible reaches of the upper Sacramento River, Antelope Creek, Battle Creek, Beegum Creek, Big Chico Creek, Butte Creek, Clear Creek, Deer Creek, Mill Creek, Feather River, and the Yuba River (CDFG 1998).

Since 1969, the spring-run Chinook ESU has displayed broad fluctuations in abundance, ranging from 1,403 in 1993 to 25,890 in 1982. The average abundance for the ESU was 12,590 for the period of 1969 to 1979, 13,334 for the period of 1980 to 1990, and 6,554 from 1991 to 2001. Evaluating the abundance of the ESU as a whole, however, masks significant changes that are occurring among metapopulations. For example, while the mainstem Sacramento River population has undergone a significant decline, the tributary populations have demonstrated a substantial increase. Average abundance of spring-run Chinook has declined from a high of 12,107 for the period of 1980 to 1990, to a low of 629 from 1991 to 2001, while the average abundance of Sacramento River tributary populations increased from a low of 1,227, to a high of 5,925 over the same period. Although tributaries such as Mill and Deer Creeks have shown positive trends in spring-run Chinook abundance since 1991, recent escapements to Butte Creek, including 9,605 in 1998 and 20,259 in 2001, are responsible for the overall increase in tributary abundance (CDFG unpublished data).

The initial factors affecting the decline of spring-run Chinook primarily stem from the loss of upstream habitat behind impassible dams. Since this initial loss of habitat, spring-run Chinook populations have continued to decline. This continuing decline is due to a combination of physical, biological, and management conditions, including climatic variation, water management, hybridization, predation, and harvest. (CDFG 1998).

Weather and ocean conditions in California can vary substantially from year to year. During the drought of 1984 to 1992, spring-run Chinook populations declined substantially. Reduced flows resulted in warm water temperatures and impacted adults, eggs, and juveniles. For adult spring-run Chinook, reduced instream flows delayed or completely blocked access to holding and spawning habitats. Water management operations, including reservoir releases, and unscreened and poorly screened diversions in the Sacramento River, Sacramento River tributaries, and the Sacramento-San Joaquin Delta compounded drought related problems by reducing river flows, warming river temperatures, and entraining juvenile spring-run Chinook.

Hatchery practices as well as spatial, and temporal overlaps of habitat use and spawning activity between spring- and fall-run Chinook led to the hybridization and homogenation of some subpopulations (DFG 1990). As early as the 1960s, Slater (1963) observed that early fall-run were competing with spring-run for spawning sites in the Sacramento River below Keswick Dam and speculated that the two runs may have hybridized. Feather River hatchery spring-run Chinook have been documented as straying throughout Central Valley streams for many years (CDFG 1997), and in many cases have been recovered from the spawning grounds of fall-run Chinook (Harvey Arrison personal communication), an indication that Feather River Hatchery spring-run may exhibit fall-run life history characteristics. Although the

degree of hybridization has not been comprehensively determined, it is clear that the populations of spring-run Chinook spawning in the Feather River and counted at RBDD contain introgressed fish.

Accelerated predation may also be a factor in the decline of spring-run Chinook. Although predation is a natural component of the spring-run Chinook life history, the rate of predation has increased through the introduction of non-native predatory species such as striped bass and largemouth bass, and augmented through the alteration of natural flow regimes and the development of structures that attract predators, including dams, bank revetment, bridges, diversions, piers, and wharfs (Stevens 1961, Vogel et al. 1988, Garcia, 1989, Decato 1978). The USFWS found that more predatory fish were found at rock revetment bank protection sites between Chico Landing and Red Bluff than at sites with naturally eroding banks (Michny and Hampton 1984). On the mainstem Sacramento River, high rates of human induced predation are known to occur at RBDD, ACID, GCID, and at the south Delta water diversion structures (CDFG 1997). From October 1976 to November 1993, CDFG conducted ten mark/recapture experiments at the State Water Projects (SWP) Clifton Court Forebay to estimate pre-screen losses using hatchery-reared juvenile Chinook. Pre-screen losses ranged from 69% to 99%. Predation from striped bass was thought to be the primary cause of the loss (CDFG 1997, Gingras 1997).

Spring-run Chinook are harvested in ocean commercial, ocean recreational, and inland recreational fisheries. Coded wire tag returns indicate that Sacramento River salmon congregate off the coast between Point Arena and Morro Bay. Ocean fisheries have affected the age structure of spring-run Chinook through targeting large fish for many years and reducing the number of four and five year olds (CDFG 1997). An analysis of six tagged groups of Feather River Hatchery spring-run Chinook by Cramer and Demko (1997) indicates that harvest rates of three-year-old fish ranged from 18% to 22%, four-year-olds ranged from 57% to 84%, and five-year-olds ranged from 97%-100%. Reducing the age structure of the species reduces it's resiliency to factors that may impact a year class. In-river recreational fisheries have historically taken fish throughout the species' range. During the summer, holding adult spring-run Chinook are easily targeted by anglers when they congregate in large pools. Poaching also occurs at fish ladders, and other areas where adults congregate, however, the significance of poaching on the adult population is unknown.

Several actions have been taken to improve habitat conditions for spring-run Chinook, including improved management of Central Valley water, new and improved screen designs at major water diversions along spring-run Chinook tributaries, and the mainstem Sacramento, and changes in ocean and inland fishing regulations to minimize harvest. Fish screen improvements, and EWA and B2 water accounts increase protection of anadromous fish through better management of Central Valley Water.

In recent years, ocean and in-river fisheries have been modified to reduce the harvest of spring-run Chinook. Ocean regulation changes include increasing the minimum size limits, constraining the harvest of winter-run Chinook and Klamath River fall-run Chinook. Existing inland fishing regulations protect a portion of spring-run Chinook adults from harvest, but allows a limited level of exploitation in the Sacramento River downstream of Deschutes Bridge, and in the Feather River downstream of the Highway 70 Bridge. Fishing regulations in tributaries such as Mill, Deer, and Antelope creeks permit seasonal angling but do not allow harvest of salmon.

Although protective measures have likely led to recent increases in spring-run Chinook abundance, the ESU is still below levels observed from the 1960s through 1990. Threats from hatchery production, climatic variation, predation, and water diversions persist. Although some metapopulations have recently declined, others, such as at Butte Creek have increased substantially. The existence of several metapopulations has aided the recent stability of the spring-run Chinook ESU, however, the number of metapopulations is considerably reduced from historic conditions and while they continue to display broad fluctuations in abundance, the ESU will remain at a moderate risk of extinction.

Central Valley Steelhead

NMFS listed the Central Valley steelhead (steelhead) ESU as threatened on March 19, 1998 (63 FR 13347). This ESU includes all naturally-produced steelhead in the Sacramento-San Joaquin River Basin. NMFS published a final 4(d) rule for steelhead on July 10, 2000 (65 FR 42422).

NMFS designated critical habitat for the steelhead on February 16, 2000 (65 FR 7764). Critical habitat consists of the water, substrate, and adjacent riparian zone of accessible estuarine and riverine reaches. Accessible reaches are those within the historical range of the ESU that can still be occupied by any life stage of steelhead. Inaccessible reaches are those longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years) and specific dams within the historical range of each ESU.

Critical habitat for steelhead is designated to include all river reaches accessible to listed steelhead in the Sacramento and San Joaquin Rivers and their tributaries in California. Also included are river reaches and estuarine areas of the Sacramento-San Joaquin Delta, all waters from Chipps Island westward to Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait; all waters of San Pablo Bay westward of the Carquinez Bridge; and all waters of the San Francisco Bay (north of the San Francisco Bay Bridge) from San Pablo Bay to the Golden Gate Bridge. Excluded are areas of the San

Joaquin River upstream of the Merced River confluence and areas above specific dams or above longstanding naturally impassable barriers.

All steelhead stocks in the of California are winter-run steelhead (McEwan and Jackson 1996). Steelhead are similar to Pacific salmon in their life history requirements. They are born in fresh water, emigrate to the ocean, and return to freshwater to spawn. Unlike other Pacific salmon, steelhead are capable of spawning more than once before they die.

The majority of the central Valley Steelhead spawning migration occurs from October through February and spawning occurs from December to April in streams with cool, well oxygenated water that is available year round. Van Woert (1964) observed that in Mill Creek, the steelhead migration is continuous, and although there are two peak periods, sixty percent of the run is passed by December 30. Similar bimodal run patterns have also been observed in the Feather River (Kurth personal communication), and the American River (Hannon personal communication).

Incubation time is dependent upon water temperature. Eggs incubate for one and a half to four months before emerging. Eggs held between 50° and 59° F hatch within three to four weeks (Moyle 1976). Fry emerge from redds within in about four to six weeks depending on redd depth, gravel size, siltation, and temperature (Shapovalov and Taft 1954). Newly emerged fry move to shallow stream margins to escape high water velocities and predation (Barnhart 1986). As fry grow larger they move into riffles and pools and establish feeding locations. Juveniles rear in freshwater for one to four years (Meehan and Bjornn 1991) emigrating episodically from natal springs during fall, winter and spring high flows (Harvey Arrison personal communication). Steelhead typically spend two years in fresh water. Adults spend one to four years at sea before returning to freshwater to spawn as four or five year olds (Moyle 1976).

Steelhead, were historically well distributed throughout the Sacramento and San Joaquin Rivers (Busby et al. 1996). Steelhead were found from the upper Sacramento and Pit River systems south to the Kings and possibly the Kern River systems and in both east- and west-side Sacramento River tributaries (Yoshiyama et al. 1996). The present distribution of steelhead has been greatly reduced (McEwan and Jackson 1996). The California Advisory Committee on Salmon and Steelhead (1988) reported a reduction of steelhead habitat from 6,000 miles historically to 300 miles. The California Fish and Wildlife Plan (CDFG 1965) estimated there were 40,000 steelhead in the early 1950s. Hallock (1961) estimated an average of 20,540 adult steelhead through the 1960s in the Sacramento River, upstream of the Feather River.

Existing wild steelhead stocks in the Central Valley are mostly confined to upper Sacramento River and its tributaries, including

Antelope, Deer, and Mill Creeks and the Yuba River. Populations may exist in Big Chico and Butte Creeks and a few wild steelhead are produced in the American and Feather Rivers (McEwan and Jackson 1996). Until recently, steelhead were thought to be extirpated from the San Joaquin River system. Recent monitoring has detected self sustaining populations of steelhead in the Stanislaus, Mokelumne, Calaveras, and other stream previously thought to be void of steelhead (McEwan 2001). It is possible that naturally spawning populations exist in many other streams but are undetected due to lack of monitoring programs (IEP SPWT 1999).

Reliable estimates of steelhead abundance are not available (McEwan 2001), however, McEwan and Jackson (1996) estimate the total annual run size for the entire system, based on RBDD counts, to be no more than 10,000 adults. Steelhead counts at the RBDD have declined from an average of 11,187 for the period of 1967 to 1977, to an average of approximately 2,000 through the 1990s (McEwan and Jackson 1996, McEwan 2001).

The factors affecting the survival and recovery of steelhead are similar to those affecting winter- and spring-run Chinook and are primarily associated with habitat loss (McEwan 2001). McEwan and Jackson (1996) attribute this habitat loss and other habitat problems primarily to water development resulting in inadequate flows, flow fluctuations, blockages, and entrainment into diversions. Other habitat problems related to land use practices and urbanization have also contributed to steelhead declines (Busby et al. 1996). Although many of the factors affecting salmon are common to steelhead, some stressors, especially summer water temperatures cause greater effects to steelhead since juvenile steelhead rear in freshwater for more than one year. Suitable steelhead conditions primarily occur in mid to high elevation streams. Because most of the suitable habitat has been lost to dam construction, juvenile rearing is mostly confined to lower elevation reaches where water temperatures during late summer and early fall can be high.

Many of the habitat improvements that have benefitted winter-and spring-run Chinook, including water management through the CVPIA B2 water supply and the CALFED EWA, improved screening conditions at water diversions, and changes in inland fishing regulations benefit steelhead, however, many dams and reservoirs in the Central Valley do not have water storage capacity or release mechanisms necessary to maintain suitable water temperatures for steelhead rearing through the critical summer and fall periods, especially during critically dry years (McEwan 2001). The future of steelhead is uncertain because of the lack of trend data, but is thought to be at a moderate risk of extinction because, although, the ESU is comprised of several metapopulations, the overall abundance of the ESU may still be declining.

IV. ENVIRONMENTAL BASELINE

The environmental baseline is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat (including designated critical habitat), and ecosystem within the 800 feet of the action area (300 feet above and 500 feet below the bridge) (USFWS and NMFS 1998).

Status of listed species and critical habitat within the action area

The action area provides spawning habitat for winter- and spring-run Chinook, and steelhead. The action area also functions as a migratory corridor for adult and juvenile winter- and spring-run Chinook and steelhead, and as juvenile rearing habitat for winter- and spring-run Chinook and steelhead. Due to the life history timing of winter- and spring-run Chinook, and steelhead, it is possible for adult migrants, spawners, incubating eggs, and rearing and emigrating juveniles to be present during the instream work window. The species and life history stages anticipated within the action area, during the instream work period, include emigrating adult steelhead, rearing and emigrating juvenile steelhead, spawning adult spring-run Chinook, incubating spring-run Chinook eggs, and rearing and emigrating juvenile winter- and spring-run Chinook.

Status of Species:

Reliable estimates of the number of winter- and spring-run Chinook adults and juveniles within the action area are not available, however general redd abundance and spawning distribution can be determined through DFG aerial redd surveys. DFG conducts monthly aerial redd surveys of the upper Sacramento River from the Ord Ferry Bridge to Keswick Dam from May through April of each year. These surveys indicate that the action area is within the primary spawning range of winter-run Chinook. Since 1995, the percentage of winter-run Chinook redds in the two survey reaches bisected by the State Route 299 bridge has ranged from 60 to 100% of the total winter-run redd count, and the percentage of spring-run Chinook redds has ranged from 24 to 100% of the total mainstem Sacramento River spring-run Chinook redd count. A review of DFG's aerial survey maps indicates that both winter- and spring-run Chinook spawning does occur in the action area, although not every year. When spawning does occur within the action area, the number of redds is usually less than 1% of the total Sacramento River redd count for each race. No other recent information on winter- and spring-run Chinook presence, distribution, or absence exists for the action area.

ECORP Environmental Consulting, Inc conducted detailed hydrologic surveys and ran HEC/RAS models to calculate water velocities within an area 600 feet up- and downstream of the bridge (ECORP 2000). The lowest velocities were observed from October through January at 3.36-4.0 feet per second (fps). All other velocities ranged from 4.0-9.0 fps throughout the year. Based on Bovee (1978) habitat suitability curves, steelhead spawn in areas with water velocities ranging from

1.0-3.6 fps, and prefer velocities of 2.0 fps, and Smith (1973) found that steelhead spawn in water velocities ranging from 1.3-2.0 fps. Despite this evidence, CDFG has recorded *O. mykiss* spawning near the bridge. Although these *O. mykiss* are recorded as rainbow trout, they are essentially indistinguishable from steelhead at the time of spawning. No other recent information on steelhead presence, distribution, or absence exists for the action area.

Although the action area provides a limited amount of spawning habitat for winter- and spring-run Chinook and steelhead, the diversity of habitat types contribute to important rearing conditions. Deep, slow water, riffles, shallow water margins, and near shore brushy riparian vegetation provide essential juvenile rearing conditions that include deep and shallow water refugia, turbulent over head cover, and aquatic insect production.

Status of Critical Habitat:

The flows in the upper Sacramento are regulated by releases from Keswick and Shasta Dams. Summer flows are closely managed to meet water temperature objectives for spawning winter- and spring-run Chinook and to provide water for irrigation. From May through August flows average approximately 12,000 cfs and water temperatures are held close to 56° F. Flows are reduced from September through December and generally range from 5,000 to 8,000 cfs. January, February, and March have the greatest probability of high flows, however the magnitude of flows depends on the intensity of the water year and available storage behind Shasta Dam. In critically dry years winter flows in the action area are frequently held below 4,000 cfs but cannot be reduced to less than 3,250 cfs. In 2001, B2 water was used to keep the river from dropping below 3,600 cfs in an effort to minimize stranding of fall-run Chinook redds.

The area surrounding the bridge site consists of a narrow strip of riparian vegetation directly adjacent to the river. Riparian vegetation is present at the southeast and northeast bridge corners. There is no vegetation under the bridge itself, and only blackberries and a few willows are present at the northwest and southwest corners. Upstream of the northwest and bridge corner, the narrow strip of riparian vegetation widens and is characterized as a dense, multi-story, mid-seral community. Approximately 20 feet upstream of the bridge is a one-half acre vegetated island. There are two large wetlands at the northwest and southwest quadrants, formed as a result of gravel extraction for Shasta Dam construction. The southwest wetland is a lagoon that supports native and introduced fishes including Sacramento pikeminnow and largemouth bass.

Section 3406(b)(13) of the CVPIA requires the Bureau of Reclamation to restore and replenish spawning gravel, and re-establish meander belts in rivers. To meet these requirements in the upper Sacramento River, spawning gravel augmentation projects have placed substrate into

various locations in the Sacramento River. In 2000, BOR placed 39,000 tons of clean washed spawning gravel into the river below Keswick Dam. Other construction projects have compensated for adverse effects to salmonids using spawning gravel augmentation. An early spawning gravel augmentation site, located upstream of the action area, was the primary contributor spawning gravel in the action area. Most of the gravel from this gravel contribution has dispersed, and been deposited several hundred downstream of the bridge.

Substrate 200 yards upstream and downstream of the current bridge location has been inventoried and classified (ECORP 2000). Based on gravel size distributions, only 16 percent of the substrate is classified as good spawning suitability for all salmonids (90% 0.5-6" gravel, low fines), approximately 29 percent is classified as fair suitability (50-90% 0.5-6" gravel), and 55 percent is classified as poor (25-50% 0.5-6" gravel, high fines) to not suitable (no spawning gravel present).

There are three large concentrations and seven small parcels of good quality salmonid spawning habitat and 2 large concentrations and 57 small parcels of fair quality spawning habitat within 200 yards upstream and downstream of the bridge site. Of the three large concentrations, one area (area #1) contains approximately 46,800 square feet of good quality spawning habitat, the second area (area #2) contains approximately 18,000 square feet of habitat, and the third area (area #3) contains approximately 50,400 square feet of spawning habitat. Area #1 is located between 240 feet downstream of the existing bridge location and extends an additional 360 feet downstream, area #2 begins directly beneath the bridge and extends 160 feet downstream, and area #3 begins directly beneath the bridge and extends 630 feet downstream. In addition to the three large concentrations of high quality spawning habitat, there are seven small, discontinuous parcels (60x60 ft grids) totaling approximately 25,200 square feet. The largest concentrations of fair quality spawning habitat are at two locations. One concentration is approximately 28,800 square feet and is located on the west side of the project area, 60 to 240 feet downstream of the bridge site. The other is approximately 21,600 square feet and is located directly beneath the southeast side of the bridge site and extends 180 feet downstream. The smaller good and fair parcels are well distributed around the bridge site.

Factors affecting species and critical habitat within the action area

The factors affecting the species and critical habitat within the action area include river flows, water temperatures, spawning gravel suitability, water quality, and riparian habitat. River flow and temperature criteria were established in the 1993 Opinion, leading to the construction of the TCD, and resulting in improved river flow and temperature management. Although these criteria have been developed to meet winter-run Chinook needs, spring-run Chinook and steelhead

have also benefitted. Gravel augmentation has resulted in localized areas of good quality spawning gravel. Riparian conditions provide limited shade, and large woody debris recruitment because the existing riparian habitat is comprised of small diameter brush, and does not form a canopy over the river.

Ongoing improvements to the Sacramento River in the vicinity of Redding are expected to further improve conditions for anadromous fish and critical habitat, but the incremental benefit of these actions is not yet known. Even with these improvements, some problems persist that may affect anadromous fish within the action area. Some of the remaining problems include episodic discharges of heavy metals from the Superfund Iron Mountain Mine site and degraded rearing conditions in the river due to a lack of riparian habitat. The frequency of acid mine drainage exceeding target levels below Keswick Dam has decreased over the last ten years, however, exceedances of dissolved copper targets have occurred during each of the last six years, and metal concentrations remain high enough to have sublethal effects on adult fish and lethal effects on eggs and larvae (RWQCB 2001). Although acid mine drainage decreases the number of Chinook salmon and steelhead within the action area, recent remedial actions at Iron Mountain Mine, have probably curtailed the loss of individuals.

Likelihood of species survival and recovery in the action area

Considering the habitat improvements that have occurred throughout the Sacramento River system, as well as near the State Route 299 bridge, it appears that winter- and spring-run Chinook and steelhead will continue to utilize the action area as a migratory corridor, and for rearing and spawning. Although the action area is quite small, relative to all of the spawning and rearing habitat available to the species, the suitability of the area in terms of its value as a migratory corridor and rearing habitat make it an important node of habitat for the survival and recovery of local populations. Because the habitat within the action area is, essentially, bounded by some of the most important habitat available to winter-run Chinook, the rearing habitat within the action area is important for the survival and recovery of the ESU. Although the habitat within the action area may be important for the survival and recovery of local populations of spring-run Chinook and steelhead, the distribution of these species throughout the geographical range of the ESU, and their primary abundance in other streams and rivers, means that the value of the habitat within the action area may not be essential for the survival and recovery of spring-run Chinook and steelhead.

V. EFFECTS OF THE ACTION

The proposed project includes actions that may adversely affect several life stages of Sacramento River winter-run Chinook, spring-run Chinook, and steelhead. Adverse effects to listed salmonids and critical habitat may result from changes in water quality from

construction activities and test drilling, loss of riparian vegetation from construction activities, and damage to incubating eggs and harassment of juvenile and adults from pile driving and gravel pad installation. The project includes integrated design features to avoid and minimize many potential impacts.

Water Quality

In-river construction and demolition work may increase suspended sediments and elevate turbidity above natural levels. Activities that could contribute sediment and increase turbidity include sheet and steel pile driving and removal, removal of existing piers, test drilling, and use of access roads and near-river staging areas. Water quality may also be affected by hydraulic and fuel line leaks and petroleum spills.

High turbidity affects salmonids by reducing feeding success, causing avoidance of rearing habitats, and disrupting upstream and downstream migration. Displacement of juveniles from preferred habitats may cause increased susceptibility of juveniles to predation. Bisson and Bilby (1982) reported that juvenile coho salmon avoid turbidities exceeding 70 NTUs, and Sigler et al. (1984) in Bjornn and Reiser (1991) found that turbidities between 25 and 50 NTUs reduced growth of juvenile coho salmon and steelhead. Turbidity should affect Chinook salmon in much the same way it affects juvenile steelhead and coho salmon because of similar physiological and life history requirements between the species.

Sediment plumes would increase turbidity at the project site and could continue downstream for several hundred feet during the instream work period of September 15 through April. Species potentially within the action are during this time are juvenile winter-run Chinook, and juvenile and adult spring-run Chinook, and steelhead. Most of the fish would only risk exposure to project related sediment while they are migrating through the action area to upstream spawning habitat or downstream toward the ocean. Rearing juveniles or holding adults in the action area could face the longest exposure. Increased sediment delivery and high levels of sediment transport can also cause scour of incubating embryos, infiltration of fine sediment into spawning gravels, decreased substrate permeability and intergravel flow and, ultimately, lead to reductions in the numbers of emergent salmonid fry (Lisle and Eads 1991, Nelson et al. 1991). Increased sediment delivery can also fill interstitial substrate spaces and reduce cover for juvenile fish (Platts and Megahan 1975) and abundance and availability of aquatic invertebrates for food (Bjornn and Reiser 1991).

Petroleum based products may degrade water quality as a result of spills or slow leaks. Petroleum products are toxic to fish. They may coat external surfaces of gills and sensory organs, such as eyes and olfactory pupae and cause asphyxia, disorientation or disease.

Emulsified petroleum products may be ingested and cause death or sublethal effects that affect survival and growth of fish (Post 1987). Although these effects may not be specific to Chinook salmon and steelhead they may be reasonably expected to occur in the event of a large spill.

Effects of project related sediment, turbidity and water quality could affect the behavior, growth, and migration of listed salmonids in the action area. Adherence to the preventative and contingency measures of the SWPP will minimize the amount of project related sediment introduced to the action area by using silt fences, straw mulch, erosion control seeding, and clean, washed work pad substrates; will minimize project related sediment plumes caused by in-river construction by removing drilling and excavation materials to locations outside of the river channel, and halting work in the event of a plume detection; and will minimize the risk of leaks and spills from equipment, and enable timely responses to spills if they occur.

These measures are designed to prevent water quality impacts from adversely affecting the behavior, growth or migration of adult and juvenile winter- and spring-run Chinook, and steelhead. In the event that a project related sediment plume does occur, it would be of short duration, since work would be suspended, and would be expected to result in a temporary change in the distribution of the species in the action area, lasting only as long as the plume was present. The effects of an equipment spill or leak would vary depending of the amount that spilled and the toxicity of the product. Adherence to a storm water prevention plan and spill prevention plan will provide protection to salmonids by minimizing risks, however, in the event that a spill or leak does occur, it could result in a temporary change in the distribution of salmonids within the action area, and depending on the toxicity and duration of exposure, could result in a reduction in numbers of juvenile winter-run Chinook, and juvenile and adult spring-run Chinook and steelhead.

Damage to Redds

Damage to redds, excluding potential water quality effects, and acoustic effects to developing embryos, may result from construction and demolition activities in the vicinity of active spawning areas. Construction activities that could damage redds include pile driving, coffer dam construction, and placement of the gravel work pad. Demolition activities that could damage redds include removal of existing bridge super structure and bridge columns.

Due to the presence of suitable spawning habitat under and around the bridge, and almost year-round spawning activity in the project area, some interaction between redds and project implementation is probable. Implementation of the winter in-water work period from September 15 through April 15 will completely avoid damage to winter-run Chinook

redds but will focus work during the spring-run Chinook and steelhead spawning period.

Although damage to spring-run Chinook redds could occur, the probability is relatively low due to recent trends in redd distribution and abundance, the amount of good quality spawning substrate (<16%) and the planned configuration of the gravel work pad. DFG aerial redd surveys, conducted annually on a biweekly basis, detected two spring-run Chinook redds near the eastern side of the bridge in 1998, but in most years spring-run chinook redds were concentrated at a riffle located approximately one half mile upstream. Construction of the gravel work pads will cover most of the good quality spawning substrate beneath the eastern side of the bridge, rendering it unavailable to salmonids for spawning and possibly reducing the suitability of the remaining spawning habitat in the action area by creating velocities that exceed the requirements of spawning spring- and winter-run Chinook and steelhead. These changes to the existing habitat will lead to a change in the distribution and reduction in the reproduction of winter-run Chinook, spring-run Chinook and steelhead within the action area.

Effects stemming from demolition will be minimized by isolating existing bridge column removal to coffer dams and collecting demolition debris on work trestles suspended above the river. Demolition activities should not affect the abundance or distribution of the salmonids in the action area.

Riparian Habitat

Riparian vegetation adjacent to the river, including shaded riverine aquatic habitat (SRA) is a component of designated critical habitat for winter- and spring-run Chinook, and steelhead. Riparian habitat is an important component of critical habitat for winter- and spring-run Chinook, and steelhead because it provides cover, shelter, shade, and contributes to food production (Platts 1991).

Approximately 1.5 acres of riparian vegetation will be removed at the northeast (NE) and southeast (SE) bridge corners, and 0.8 acres will be removed along the southwest (SW) approach. The NE corner contains mid-seral riparian vegetation comprised of black locust, valley oak, interior live oak, grey pine, and Oregon ash. The SE corner is primarily comprised of early seral willow. The SW approach is sparsely inhabited by willows and non-native shrubs.

Removal of riparian habitat will affect winter- and spring-run Chinook and steelhead by reducing the amount of overhanging and submerged vegetation, reducing the cover for fish, and reducing the terrestrial food supply. Removal of riparian vegetation is not expected to affect water temperature because the extent of shade is not sufficient to

overcome the effects of water temperature controlled through cold water releases from Shasta Reservoir.

Construction related impacts to riparian vegetation and SRA will be minimized by limiting the amount of riparian vegetation removal to access sites and embankment fill, and replacing lost vegetation by replanting the project site with native riparian species and planting six acres of riparian vegetation along lower Sulphur Creek or at Battle Creek. The bridge replacement design will eventually result in a smaller area of river-bed occupied by bridge piers and therefore a greater amount of habitat available to salmon than is currently available with the existing bridge.

The reduction of riparian habitat will affect species utilizing the action area for ten to 20 years following construction, or until the existing vegetation conditions can become re-established. Willows will revegetate most quickly and may contribute to fish habitat in less than ten years, however, the mid-seral vegetative communities that contribute the large woody component of SRA may take more than 20 years to be replaced. Since the area is dominated by shrubs and willows, most of the existing habitat features should be replaced in ten years. Any species utilizing the action area during this recovery period will probably face reduced levels of overhead cover and food production. Because of the diverse habitat conditions in the action area, other forms of overhead cover (pools and riffles), and food production are present and will probably prevent the loss of riparian habitat from contributing to a reduction in the number of individuals.

Gravel Work Pads

Work pads will be constructed of uncrushed, rounded natural river rock, between one and four inches in diameter, and with a cleanliness value of no less than 85% on the east side of the channel. The purpose of the gravel pads is to increase the amount of dry work area available during construction and to cover a large concentration of good quality spawning gravel under the bridge.

The presence of the pads will temporarily reduce the amount of suitable spawning habitat within the action area. This will result in a temporary reduction in the number of spring-run Chinook and steelhead that spawn and reproduce in the action area. The intent of covering spawning gravel is to prevent spring-run Chinook and steelhead from spawning at the construction site and having their redds destroyed or damaged by project related disturbances. Extensive high quality spawning habitat exists outside of the action area. Utilization of this habitat is currently below carrying capacity for spring-run chinook and steelhead. Spring-run Chinook and steelhead displaced by gravel pads will probably relocate to spawn at those sites.

Construction of the pad will be in the last two weeks of April. There is a chance that when the pad is constructed it will be built over viable steelhead redds made in late March and early April. Covering these redds would result in a reduction in the number of steelhead eggs and larvae. The most likely effect of installing the pad is the harassment of juvenile salmon and steelhead that are temporarily frightened by the sound of gravel sliding into the river.

Pile Driving and Bridge Demolition

Pile driving consists of driving steel pile columns and sheets into the riverbed with a mechanical hammer. The force of the hammer hitting a pile forms a sound wave that travels down the pile and causes the pile to resonate radially and longitudinally. Acoustic energy is formed as the walls of the steel pile expand and contract, forming a compression wave that moves through the pile. The outward movement of the pipe pile wall sends a pressure wave propagating outward from the pile and through the riverbed and water column in all directions. Demolition activities generate sounds that can be passed through the water column.

The effect pile driving has on fish depends on the duration, frequency (Hz), and pressure (dB) of a compression wave. Salmonids hear within a range of 10 to 400 Hz, with the greatest sensitivity between 180 and 190 Hz (Feist 1992). Atlantic Salmon are functionally deaf at frequencies above 380 Hz. Rassmusen (1967) found that immediate mortality of juvenile salmonids may occur at sound pressure levels exceeding 204 dB. Due to their size, adult salmon and steelhead can tolerate higher pressure levels and immediate mortality rates for adults are expected to be less than that experienced by juveniles (Hubbs and Rechnitzer 1952). Moore and Newman (1956) and Burner and Moore (1962) found that large juvenile and adult fish rarely respond to sudden or loud sound stimuli, and experiments by McKinley and Patrick (1986) using pulsed sound (similar to pile driving) rather than continuous sound, found that juvenile fish demonstrated a startle or avoidance response.

Feist et al. (1992) found that pile-driving in Puget Sound created sound within the range of salmonid hearing that could be detected at least 600 m away. Abundance of juvenile salmon near pile driving rigs was reduced on days when the rigs were operating compared to non-operating days. Pile driving may result in "agitation" of salmonids indicated by a change in swimming behavior (Shin 1995). This suggests that pile driving may cause avoidance of habitat in the immediate vicinity of the project site.

The range and intensity of a compression wave is related to the size of the hammer and the medium through which the wave travels. Large hammers will result in high pressures, or decibels, and dense mediums will result in effective transmission of compression waves. Small hammers will result in low pressures and inconsistent mediums (mediums

with variable or changing densities) will result in transmission loss, or attenuation, of the wave. The pressure of a compression wave will decrease with distance and the range of the wave will decrease in proportion to the rate of transmission loss.

Because inconsistent mediums, such as water, will result in a higher rate of transmission loss, environmental factors such as water depth, water turbulence, air bubbles, and substrate consistency are important to consider when estimating the distance a compression wave will travel. A compression wave traveling through shallow water and substrates with variable consistencies (variable particle size class distribution) will attenuate more rapidly than compression waves traveling through a constant medium such as deep water or bedrock. As a compression wave moves away from the source, the wave length increases and intersects with the air/water interface. Once the compression wave contacts the air, it attenuates rapidly and does not return to the water column.

River characteristics within the action area vary from shallow water with gravel substrate to deep water with sand and silt substrate. Water depths vary from one to twelve feet deep. Approximately two thirds of this area can be characterized as moderately shallow with gravel, cobble, or boulder substrates and moderately fast flowing water. The deepest part of the river is located in the northwestern portion of the existing bridge site. HEC/RAS modeling conducted within 200 yards upstream and downstream of the bridge indicate that river velocities are lowest from September through January and range from 3.4 to 4 ft/sec. High summer discharges are common in the Sacramento River to meet irrigation needs, and low flows are common during the winter storage period at Shasta Reservoir. Throughout the rest of the year, velocities range from 4 to 9 ft/sec. Narrowing the channel width with gravel pads will increase the range of maximum velocities.

Since little is known about the effects of compression shock waves on fish eggs incubating within a gravel matrix, the effect of pile driving on salmon and steelhead eggs is less clear. Salmon and steelhead eggs are very fragile, and thus susceptible to mechanical shock prior to the eyed egg stage (Jensen and Aldrich 1983, Piper et al. 1982). During this period of development, high pressure compression shock waves may cause egg mortality in redds that are close to pile driving activities.

At the City of Sacramento Water Treatment Plant Fish Screen Project, engineering analysis anticipated sound pressure levels from pile driving would reach 95 to 120 dB, capable of startling salmonids, but not sufficient to cause lethal or sublethal effects. In planning for the replacement of the Diestelhorst Bridge in Redding California, engineering analysis concluded that driving small piles would adversely effects salmon and steelhead eggs for up to 150 feet, and large "H" pile driving would adversely effect eggs for up to 150 yards

away from the sound pressure source (Rectenwald personal communication). In order to determine these distances at Diestelhorst, Caltrans engineers used the static and oscillating pressure thresholds for salmon eggs identified by Sutherland and Ogle (1975) and by the Alaska Cooperative Fish and Research Unit (1993). These thresholds were initially recognized through evaluating the effects of jet boats on salmon eggs, and were considered applicable for evaluating the effects of pile driving because they are based on sound pressure.

Although there are no similarities in river characteristics between the Sacramento Water Treatment Plant Fish Screen Project site and the State Route 299 project site, effects to salmonids should be similar, if not less at the State Route 299 site because the shallower, faster, more turbulent water at State Route 299 would attenuate sound effects more readily. Due to similarities in river and substrate conditions at State Route 299 and the Diestelhorst Bridge, including substrate, water depth, velocity, and turbulence, sound effects from pile driving should be similar.

After considering the environmental variables at the project site, the physical behavior of compressional shock waves, and the life history of listed salmonids in the action area, adult and juvenile winter-run Chinook, spring-run Chinook, and steelhead are expected to experience startle responses and temporary interruption of migration as a result of pile driving and demolition activities. Spring-run Chinook and steelhead eggs deposited within 150 yards of "H" pile driving and within 150 feet of sheet and small pile driving are expected to die. Winter-run Chinook eggs will not be affected because no pile driving will occur during their incubation period. Migration delays are expected to be temporary, and last, at a maximum, for the duration of the daylight operation hours of the hydraulic hammer. With a minimum of night time passage, pile driving will not prevent adult and juvenile salmon from passing through the construction site. On similar bridge projects, such as the replacement of the I-5 bridge over the Sacramento River near Anderson, lapses in pile driving activity are common throughout the day because construction crews delay hammer work for equipment maintenance, to shift from one pile to another, and to take breaks (Whitley personal communication). These construction lapses will increase the ability of fish to migrate through the action area.

Pile driving activities will last for up to three years, resulting in some long-term effects. Frequent interruptions in pile driving, including daily and seasonal breaks, combined with the ability of juveniles and adults to avoid the project area, will minimize the adverse effects of sustained exposure to sound.

Coffer Dams

Closure of coffer dams may entrap Winter-run Chinook, spring-run Chinook, and steelhead juveniles. The timing of coffer dam closure could correspond with the tail end of the winter-run Chinook migration, and will take place during spring-run Chinook and steelhead rearing and emigration. The coffer dam installation process will probably startle most of the salmon near the construction site and cause them to leave the immediate area of work, however it is possible that some fish will be entrained when the coffer is closed. Any fish that are left within the coffer dam would be expected to die when the coffer is pumped dry. Conducting a fish salvage in closed coffer dams will reduce the mortality associated with pumping. Any fish recovered from a coffer dam would be relocated downstream. A small mortality rate (probably less than 10% when compared to the fish handling of other fish salvage efforts) is expected from capturing and handling.

Fish Passage

The combination of coffer dams and the gravel work pad occupying space in the river will reduce the width of the river and increase water velocities. An increase in water velocities will not prevent juveniles from passing downstream to rear, but could hinder the upstream migration of adult salmon. Caltrans will maintain at least 200 feet of unconfined river flow through the project area. At the I-5 Bridge Replacement Project near Anderson, the gravel work pad and coffer dams have constricted the channel width to approximately 100 feet. This constriction has not resulted in velocities capable of preventing the upstream migration of adult salmon and steelhead. Using Sacramento River fall- and winter-run Chinook as an example of fish passage effectiveness, in 2001, 98.8% of winter-run Chinook and 68.6% of fall-run Chinook spawned upstream of. This distribution is similar to previous years, prior to the construction period. Because replacement techniques at the State Route 299 bridge will be similar to the Anderson Bridge, will maintain a greater width of unconfined channel, and will result in similar flow conditions, no effects to fish passage, other than the delays related to pile driving and other sounds are anticipated.

VI. CUMULATIVE EFFECTS

For purposes of the ESA, cumulative effects are defined as the effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within an action area of the Federal action subject to consultation (50 CFR 402.02). Future Federal actions are not included here because they require separate consultation pursuant to section 7 of the ESA.

Non-federal actions that may affect the action area include population changes and urbanization, other highway and bridge work, and habitat restoration. During the period of 1980 to 1990 the population of Redding increased by 27%, and from 1990 to 2000 increased by 11%. For

the next 25 years, the projected population increase for the Redding area is 29.9% (U.S. Census Bureau 2000). Increased development is expected to occur concurrent with Redding's population expansion. Population growth and urbanization may adversely affect water quality in the action area as the amount of impervious surface area increases, resulting in peaking hydrographs of contaminated urban runoff.

It is difficult to predict what effect these actions will have on listed salmonids. Habitat restoration will probably continue to improve conditions for salmonids by increasing their range, distribution, and natural production, however the effectiveness of restoration for offsetting the adverse effects related to urban growth are not fully known.

VII. INTEGRATION AND SYNTHESIS OF EFFECTS

Impacts of the proposed action on winter-run Chinook, Central Valley spring-run Chinook, and Central Valley steelhead

NMFS finds that Caltrans will take steps to avoid winter-run Chinook spawning adults and incubating eggs by deferring all in-water work to a winter work window. Adverse effects to spring-run Chinook and steelhead redds will be minimized by constructing a gravel pad over the greatest concentrations of high quality spawning gravels in the action area prior to in-water construction at a time when there is the least chance of spawning activity. Since the tail end of steelhead spawning may overlap with installation of the pad the potential exists for a small number of steelhead redds to be damaged by the gravel pad installation. The potential also exists for coffer dam installation and pile driving to adversely affect spring-run Chinook and steelhead redds, although this potential appears to be small because of the limited availability of suitable spawning habitat at proposed coffer dam and pile driving locations and recent trends in redd distribution in the action area. If redds are constructed in the action area, incubating eggs may be killed from river bed vibrations and sound pressures related to pile driving. Some juvenile anadromous fish may be entrained into coffer dams when they are closed. Pile driving, gravel pad installation, and demolition activities are likely to harass adult and juvenile winter-run Chinook, spring-run Chinook, and steelhead.

Effects to all listed anadromous species stemming from test drilling, loss of riparian vegetation, and other construction activities that may contribute sediment and increase turbidity will be further avoided or minimized by meeting RWQCB water quality objectives, Caltrans water pollution specifications, implementing applicable BMPs, staging equipment outside of the riparian corridor, limiting the amount of riparian vegetation removal, and replacing lost riparian vegetation at the project site and at six acres at Sulphur or Battle Creek.

The most likely effects to listed salmonids, resulting from the proposed action, are harassment of adult and juvenile winter-run Chinook, spring-run Chinook, and steelhead resulting from the noise of pile driving, and entrainment of juveniles into coffer dams. Harassment is expected to result in temporary disruptions in the migratory behavior of adult and juvenile salmonids but not prevent these fish from passing upstream of downstream. Entrainment related effects will be minimized through fish salvage. A low mortality rate of juveniles (<10%) will be associated with fish salvage. The possibility of egg mortality exists, but is expected to be low and will only occur if redds are spring-run Chinook or steelhead redds are built near the construction site.

Impacts of the proposed action on critical habitat

Critical habitat will be adversely affected by loss of approximately 2.6 acres of riparian vegetation, temporary occupation of the riverbed and water column by coffer dams, and occupation of the riverbed and water column by the gravel work pad. Temporary losses of critical habitat in the river channel will affect anadromous species by reducing the onsite rearing and spawning habitat.

The loss of riparian vegetation at the project site will be approximately five to 20 years. Revegetating the project site and six additional acres offsite will quickly offset the adverse effects of small-sized riparian vegetation, however, habitat attributes related to large wood will not be realized for much longer. Construction of the gravel work pad will affect critical habitat by covering and altering the hydrology of suitable spawning habitat for four years, but will ultimately improve spawning within the action area following the construction period as gravels are redistributed and made available to spawning fish.

These effects to critical habitat may result in a temporary redistribution of some individuals, primarily spawning adult spring-run Chinook and steelhead, and rearing juvenile winter- and spring-run Chinook and steelhead, but, due to the temporary nature of these effects, and the long-term improvement expected from revegetating the project site, vegetating six acres at Sulphur of Battle Creeks, and increasing the amount of spawning gravels in the action area, these effects will not appreciably diminish the value of critical habitat for supporting the survival and recovery of winter- and spring-run Chinook and steelhead.

Impacts of the proposed action on ESU survival and potential for recovery

The adverse effects to winter-run Chinook, spring-run Chinook, and steelhead within the action area are not expected to affect the overall survival and recovery of the ESUs. This is largely due to the fact that the construction related harassment will be temporary and

will not impede adult fish from reaching upstream spawning and holding habitat, or juvenile fish from migrating to downstream rearing areas, and because egg mortalities from pile driving will be minimized by taking measures to reduce the suitability of substrate for spawning. Additionally, the project will compensate for temporary losses of riparian vegetation, and spawning habitat in the action area will ultimately be improved through the introduction clean, washed gravel. The bridge replacement design will eventually result in a smaller area of river-bed occupied by the bridge footprint and therefore a greater amount of habitat available to salmon than is currently available with the existing bridge.

VIII. CONCLUSION

After reviewing the best scientific and commercial data available, including the environmental baseline, the effects of the proposed project, and the cumulative effects, it is NMFS' biological opinion that the State Route 299 Bridge Replacement Project is not likely to jeopardize the continued existence of endangered winter-run Chinook, threatened spring-run Chinook, and threatened steelhead, and is not likely to destroy or adversely modify designated critical habitat.

IX. INCIDENTAL TAKE STATEMENT

Take is defined as harass, harm, pursue, hunt, shoot, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Harm is further defined to include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding or sheltering. Incidental take is defined as take that is incidental to, and is not the purpose of the carrying out of an otherwise lawful activity conducted by the Federal agency or an applicant. Under the terms of section 7(b)(4) and section 7(o)(2) of the ESA, taking that is incidental to and not intended as part of the agency action is not considered a prohibited taking under the ESA, provided that such taking is in compliance with this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by FHWA and Caltrans so that they become binding conditions of any grant or permit, as appropriate, for the exemption in section 7(o)(2) to apply. FHWA has a continuing duty to regulate the activity covered by this Incidental Take Statement. If FHWA (1) fails to assume and implement the terms and conditions of the Incidental Take Statement or (2) fails to require Caltrans to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, Caltrans must report the progress of the action

and its impact on the species to the NMFS as specified in the incidental take statement [50 CFR § 402.14(i)(3)].

A. Amount or Extent of Take

NMFS anticipates that the action covered by this opinion has more than a negligible likelihood of resulting in incidental take of winter-run Chinook, spring-run Chinook, and steelhead because of the presence of juvenile and adult fish in the vicinity of the project area during in-water work and the amount of in-water work required. Incidental take associated with this action is anticipated to be in the form of mortality of spring-run Chinook and steelhead eggs, and harassment of winter-run Chinook, spring-run Chinook, and steelhead juveniles and adults because of the impacts related to pile driving, test drilling, coffer dam construction, loss of riparian habitat. A small level of harassment and mortality (<10% of all fish collected) is anticipated as a result of implementing a fish salvage effort within coffer dams.

The magnitude of incidental take associated with the proposed project cannot be accurately quantified because of the variability and uncertainty in the population size of each species, the timing of migration, and the species' variable habitat use in the project area, although it is possible to describe the conditions that will lead to this take. The activities that are likely to result in take include pile driving, test drilling, gravel pad installation, and coffer dam installation, removal of riparian habitat, and fish salvage.

Pile driving and test drilling will result in the creation of sound pressures and substrate vibrations that will harass listed adult and juvenile salmonids, and kill the eggs of spring-run Chinook and steelhead. Test drilling will occur prior to any bridge construction work and will result in a short-term harassment of juvenile and adult listed salmonids. Pile driving, which will occur during the winter months for the first three years of the project, has the highest probability of adversely affecting listed anadromous fish by harassing individuals with loud noise, and killing eggs with high sound pressures and riverbed vibrations. Gravel pad construction may harass or kill listed species when gravels are deposited into the river.

Loss of approximately 2.6 acres of riparian habitat will harm listed salmonids by reducing food production and cover for five to 20 years. Loss of food production and near shore cover are expected to harm listed salmonids for five to ten years, and the loss of large woody debris associated mid-seral riparian vegetation are expected to harm listed salmonids through reduced habitat diversity and complex cover for up to 20 years.

Fish salvage will occur following the construction of coffer dams. Cofferdam construction, and subsequent fish salvages are anticipated to occur during the fall, winter, and spring, for up to three years.

Fish salvage will harass, and may kill, juveniles when they are captured and relocated.

Anticipated incidental take may be exceeded if the project is not implemented as described in the BA (2001), as amended by subsequent letters providing additional information, and if the project is not implemented in compliance with the terms and conditions of this incidental take statement.

B. Reasonable and Prudent Measures

NMFS has determined that the following reasonable and prudent measures (RPMs) are necessary and appropriate to minimize the incidental take of listed anadromous salmonids.

1. Measures shall be taken to minimize incidental take of listed anadromous fish by restricting and isolating in-water work to avoid vulnerable life stages.
2. Measures shall be taken to minimize the effects of temporary and permanent loss of riverine and riparian habitat.
3. Measures shall be taken to maintain unimpaired passage for salmonids of all age classes through the project site.
4. FHWA/Caltrans shall provide a yearly report summarizing construction activities, species status within 200 yards upstream and downstream of the bridge site, avoidance and/or minimization measures taken, and any observed take incidents.

C. Terms and Conditions

1. Measures shall be taken to minimize incidental take of listed anadromous fish by restricting and isolating in-water work to avoid vulnerable life stages.
 - a. All pile and sheet driving shall be restricted to September 15 to April 15. Percussive work may be started on September 1 provided there are no winter-run Chinook redds within 200 yards upstream or downstream of the State Route 299 bridge.
 - b. The gravel work pad will be maintained for the duration of the bridge replacement and allowed to wash away following the completion all in-water work. To minimize effects to winter-run Chinook and steelhead, the gravel pad must be in place prior to May 1 but no earlier than April 15.

- c. The gravel will be washed and have a cleanliness value no less than 85% to minimize the introduction of fine sediments into the river.
 - d. Gravel size will be between 1 and 4 inches in diameter, and will be uncrushed, rounded natural river rock with no sharp edges.
 - e. Pier removal will be isolated from flowing water using sheet pile coffer dams.
 - f. FHWA and Caltrans shall develop a fish salvage plan and coordinate with the construction contractor to rescue fish from within coffer dams. Any fish salvage efforts should be conducted by fishery biologists or technician with at least two years experience handling federally listed anadromous fish.
 - g. FHWA and Caltrans shall conduct acoustic studies within the water column and the substrate of the Sacramento River to monitor the range and magnitude of compressional shock waves generated by pile driving operations at the State Route 299 Bridge Replacement Project.
2. Measures shall be taken to minimize temporary and permanent loss of riparian and riverine habitat.
- a. If the gravel work pad does is not sufficiently render all of the suitable spawning habitat within 200 feet upstream and downstream of the eastern side of the bridge unsuitable to spawning, it shall be extended, as appropriate, to create flow conditions that are unsuitable for salmon and steelhead spawning, maintained for the duration of the bridge replacement, and allowed to wash away following the completion all in-water work.
 - b. The preliminary riparian restoration plan prepared by the Sacramento Watershed Action Group shall be finalized and implemented.
3. Measures shall be taken to maintain unimpaired fish passage through the project site.
- a. Caltrans shall avoid constricting the channel to a degree that would result in velocities or conditions that would restrict the passage of adult and juvenile fish. Caltrans shall maintain a total of at least 200 feet of unconfined river width for fish passage and shall follow the NMFS stream crossing guidelines found on the NMFS Southwest Region website at:
<http://swr.ucsd.edu/habitat.htm>.

- b. Establish non-work periods at night to allow quiet passage for anadromous fish.
- 4. FHWA/Caltrans shall provide a yearly report summarizing construction activities, species status within 200 yards upstream and downstream of the bridge site, avoidance and/or minimization measures taken, and any observed take incidents.
 - a. FHWA/Caltrans shall provide a summary report by December 31 of each construction year detailing in-water construction activities, identifying the number of winter- and spring-run Chinook and steelhead redds within 200 yards upstream and downstream of the bridge site on maps, and describing any redds that were damaged as a result of in-water construction activities.
 - b. If a listed species is observed injured or killed by project activities, FHWA/Caltrans shall immediately contact NMFS at 650 Capitol Mall, Suite 8-300, Sacramento, CA 95815. Notification shall include species identification, the number of fish, and a description of the action that resulted in take. If possible, dead individuals shall be collected, placed in an airtight bag, and refrigerated with the aforementioned information until directed to do otherwise by NMFS.
 - c. The spawning gravel restoration and fish salvage plan shall be submitted to NMFS for review and approval no later than December 1, 2002.
 - d. The Sacramento Watershed Action Group final riparian restoration plan shall be submitted to NMFS no later than December 1, 2002.

Updates and reports required by these terms and conditions shall be submitted to:

Office Supervisor
Sacramento Area Office
National Marine Fisheries Service
650 Capitol Mall, Suite 8-300
Sacramento CA 95814
FAX: (916) 930-3629
Phone: (916) 930-3600

X. CONSERVATION RECOMMENDATION

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened

species. These conservation recommendations include discretionary measures that the FHWA and Caltrans can take to minimize or avoid adverse effects of a proposed action on a listed species or critical habitat or regarding the development of information. In addition to the terms and conditions of the Incidental Take Statement, NMFS provides the following conservation recommendations that would reduce or avoid adverse impacts on the listed species:

1. Utilize the results of the acoustic studies to evaluate the effects of pile driving on salmonids in order to develop site specific avoidance and minimization measures for future bridge projects.

XI. REINITIATION OF CONSULTATION

This concludes formal consultation on the proposed State Route 299 Bridge Replacement Project. Reinitiation of formal consultation is required if (1) the amount or extent of taking specified in any incidental take statement is exceeded; (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) the action is subsequently modified in a manner that causes an effect to the listed species that was not considered in the biological opinion; or (4) a new species is listed or critical habitat is designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, formal consultation shall be reinitiated immediately.

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MAGNUSON-STEVEN'S FISHERY CONSERVATION AND MANAGEMENT ACT

ESSENTIAL FISH HABITAT CONSERVATION RECOMMENDATIONS

Agency: Federal Highway Administration

Activity: State Route 299 Bridge Replacement Project

Consultation Conducted By: Southwest Region, National Marine Fisheries Service

Date Issued:

I. IDENTIFICATION OF ESSENTIAL FISH HABITAT

This document represents the National Marine Fisheries Service's (NMFS) Essential Fish Habitat (EFH) consultation based on our review of information provided by the Federal Highway Administration (FHWA) and the California Department of Transportation (Caltrans) on the State Route 299 Bridge Replacement Project. The Magnuson-Stevens Fishery Conservation Act (MSA) as amended (U.S.C 180 et seq.) requires the identification of EFH and the implementation of measures to conserve and enhance the habitat of Federally managed fishery species with a fishery management plan (FMP) that may be adversely affected by a federal action. The geographic extent of freshwater EFH for Pacific salmon in the Sacramento River includes waters currently or historically accessible to salmon within hydrologic units 18020109 (lower Sacramento River) and 18020112 (upper Sacramento River to Clear Creek).

EFH is defined as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. For the purpose of interpreting the definition of essential fish habitat, "waters" includes aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means habitat required to support a sustainable fishery and a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers all habitat types used by a species throughout its life cycle.

The BO addresses Chinook salmon listed under the both the Endangered Species Act (ESA) and the MSA that will be potentially affected by the proposed action. These salmon include the Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*) and Central Valley spring-

run Chinook salmon (*O. tshawytscha*). This EFH consultation will concentrate on the Central Valley fall- and late-fall run Chinook salmon (*O. tshawytscha*) since they are covered under the MSA and not listed under the ESA.

Historically, Central Valley fall-run Chinook salmon (fall-run Chinook) generally spawned in the Central Valley and lower-foothill reaches up to an elevation of approximately 1,000 feet. Much of the historical fall-run spawning habitat was located below existing dam sites and the run, therefore, was not as severely affected by water projects as other runs in the Central Valley. Some habitat was lost behind dams and early efforts were made to trap fish at dam sites and relocate them to hatcheries. From 1943 to 1946 thousands of fall-run Chinook gathering at the Shasta Dam site were either trapped and transported to the Coleman National Fish Hatchery or left in the river to spawn naturally.

The historical abundance of fall- and late-fall run Chinook is poorly documented (Myers et al. 1998) and complete estimates are not available until 1953 (USFWS 1995). From the late 1930s to the late 1950s estimates for mainstem Sacramento River fall-run were obtained from spawning surveys and ladder counts at the Anderson-Cottonwood Irrigation Dam. Although surveys were not consistent or complete, they did yield population estimates for Sacramento River fall-run ranging from 102,000 to 513,000 fish (Yoshiyama et al. 1998). Average escapement from the 1953 to 1966 was 179,000 fish and from 1967 to 1991 was 77,000 (USFWS 1995). From 1992 to 1997 the estimated Sacramento River fall-run population has ranged from 107,300 to 381,000 fish (Yoshiyama et al. 1998). The average recent (5 year) escapement of naturally produced fall-run Chinook is above 190,000; however 20-40 percent of these natural spawners are of hatchery origin.

In the Sacramento system, fall- and late-fall-run Chinook have been produced at hatcheries for over a century. Since the construction of major Central Valley dams, fall run numbers have been heavily influenced by hatchery production at the Coleman, Feather River, and Nimbus fish hatcheries. Dettman et al. (1987) estimate that from 1978 to 1984 hatchery contributions to Sacramento basin stocks ranged from 22 to 87% while Cramer (1989) concluded that hatchery contributions to the Sacramento River fall-run totaled 33% of total escapement.

Although the abundance of fall-run Chinook is relatively high, several factors continue to affect habitat conditions in the Sacramento River including loss of fish to unscreened agricultural diversions, predation by warm-water fish species, lack of rearing habitat, regulated river flows, high water temperatures, and reversed flows in the Delta that draw juveniles into State and Federal water pumps.

LIFE HISTORY AND HABITAT REQUIREMENTS

Central Valley fall-run Chinook enter the Sacramento River from July

through December and late-fall run Chinook enter between October and March. Fall-run generally spawn from October through December and late-fall Chinook spawn from January to April. The physical characteristics of Chinook spawning beds varies considerably. Chinook salmon will spawn in water that ranges from a few centimeters to several meters deep provided that there is suitable sub-gravel flow (Healey 1991). Spawning typically occurs in gravel beds that are located in marginally swift riffles, runs and pool tails with water depths exceeding one foot and velocities ranging from one to 3.5 feet per second. Preferred spawning substrate is clean loose gravel ranging from one to four inches in diameter with less than 5% fines (Reiser and Bjornn 1979).

Fall-run eggs incubate between October and March, and juvenile rearing and smolt emigration occurs from January through June (Reynolds et al. 1993). Shortly after emergence, most fry disperse downstream towards the Delta and estuary while finding refuge in shallow waters with bank cover formed by tree roots, logs, and submerged or overhead vegetation (Kjelson et al. 1982). These juveniles feed and grow from January through mid-May, and emigrate to the Delta and estuary from mid-March through mid-June (Lister and Genoe 1970). As they grow, the juveniles associate with coarser substrates along the stream margin or farther from shore (Healey 1991). Smolts generally spend a very short time in the Delta and estuary before entry into the ocean.

II. PROPOSED ACTION.

Caltrans proposes to replace the State Route 299 Bridge across the Sacramento River immediately east of downtown Redding, in Shasta County, California. The proposed action is described in the Section II, *Description of the Proposed Action* in the BO (Enclosure 1).

III. EFFECTS OF THE PROJECT ACTION

The effects of the proposed action on Sacramento River winter-run Chinook salmon and Central Valley spring-run Chinook salmon are described in Section V *Effects of the Action* and Section VII *Synthesis of Effects* of Enclosure 1, in the BO.

The upper mainstem Sacramento river provides important spawning and rearing habitat for fall-run Chinook. The proposed action may affect fall-run habitat through changes in water quality from construction activities, changes in spawning bed suitability resulting from gravel pad construction, and temporary loss of riparian vegetation. Most of these effects will be temporary and most are expected to only last for the duration of the project. Changes in water quality will be minimized or avoided through meeting RWQCB water quality objectives, Caltrans water pollution specifications, implementing applicable BMPs, and staging equipment outside of the riparian corridor. These measures will minimize the amount of project related sediment introduced to the action area by using silt fences, straw mulch,

erosion control seeding, and clean, washed work pad substrates; will minimize project related sediment plumes caused by in-river construction by removing drilling and excavation materials to locations outside of the river channel, and halting work in the event of a plume detection; and will minimize the risk of leaks and spills from equipment, and enable timely responses to spills if they occur.

Effects of riparian loss will extend past the construction period but will ultimately be offset through onsite revegetation and planting six acres at either Sulphur Creek or Battle Creek. Removal of riparian habitat will affect fall-run Chinook by reducing the amount of overhanging and submerged vegetation, reducing the cover for fish, and reducing the terrestrial food supply. Removal of riparian vegetation is not expected to affect water temperature because the extent of shade is not sufficient to overcome the effects of water temperature controlled through cold water releases from Shasta Reservoir.

Construction related impacts to riparian vegetation and SRA will be minimized by limiting the amount of riparian vegetation removal to access sites and embankment fill, and replacing lost vegetation by replanting the project site with native riparian species and planting six acres of riparian vegetation along lower Sulphur Creek or at Battle Creek. The bridge replacement design will eventually result in a smaller area of river-bed occupied by bridge piers and therefore a greater amount of habitat available to salmon than is currently available with the existing bridge.

The reduction of riparian habitat will affect species utilizing the action area for ten to 20 years following construction, or until the existing vegetation conditions can become re-established. Willows will revegetate most quickly and may contribute to fish habitat in less than ten years, however, the mid-seral vegetative communities that contribute the large woody component of SRA may take more than 20 years to be replaced. Since the area is dominated by shrubs and willows, most of the existing habitat features should be replaced in ten years. Any species utilizing the action area during this recovery period will probably face reduced levels of overhead cover and food production. Because of the diverse habitat conditions in the action area, other forms of overhead cover (pools and riffles), and food production are present and will probably prevent the loss of riparian habitat from contributing to a reduction in the number of individuals.

The changes in spawning substrate suitability stemming from the construction on the gravel pad will reduce the amount of spawning habitat at the project site during the construction period, but will increase suitable spawning substrate following construction as the gravel pad washes away. The bridge design will eventually result in a smaller area of river-bed occupied by bridge piers and therefore a greater amount of habitat available to salmon than is currently available with the existing bridge.

IV. CONCLUSION

Upon review of the effects of the State Route 299 Bridge Replacement Project, NMFS believes that the project will result in temporary adverse effects to the EFH of Pacific Chinook salmon protected under the MSA.

V. EFH CONSERVATION RECOMMENDATIONS

Considering that the habitat requirements of Central Valley fall/late fall-run Chinook salmon within the action area are similar to the federally listed species addressed in the BO, NMFS recommends that Reasonable and Prudent Measures 1, 2, 3, and 4 and Terms and Conditions 1a-e, 2a,b, 3a,b, 4a,c,d, listed in the Incidental Take Statement prepared for the Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead ESUs be adopted as EFF Conservation Recommendations.

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